This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

MANUALS FOR TEACHING

NEW SERIES

No. 1

Manuals of the Science and Art of Teaching

FIRST SERIES—No. I.

THE

CULTIVATION OF THE SENSES

LONDON
NATIONAL SOCIETY'S DEPOSITORY
BROAD SANCTUARY, WESTMINSTER
1879

2621 f. 72

[All rights reserved]

These Manuals, with the exception of the last of each series, have been written, at the request of the Literature Committee of the National Society, by men distinguished at their several Universities, and possessed of large experience either as teachers or examiners. The last of each series, that on Class Teaching and that on Apparatus, is the work in each case of a Lecturer on Method at one of the larger Training Colleges.

The writers have endeavoured in each case to connect the practice of teaching with the fundamental principles on which it should rest, and to bear in mind the capacities and needs of the particular class of readers for which these Manuals are specially intended. The chapters have been broken up into short paragraphs, with conspicuous headings, and simplicity of language has been uniformly aimed at.

In order to obtain greater clearness and precision, and to save cross-references from one Manual to another, each subject has been treated independently, and is complete in itself. This independence of authorship has necessarily caused some repetition of matter, but it will be seen that this slight addition to the bulk of the whole has largely contributed to the definiteness and completeness of the separate parts.

THE CULTIVATION OF THE SENSES.

CHAPTER I.

INTRODUCTION.

HERE is a new-born infant lying in its cradle. The physical mechanism of its body is complete in all its parts and already in motion. It has organs of sight, hearing, touch, taste, and smell. It has nerves to convey the impressions made on those organs to its brain, and other nerves to direct its movements. But as yet, so far as knowledge of the external world is concerned, its mind is a perfect blank, like this sheet of paper was before it was printed on. Impressions are made upon its senses; images are formed on the retina of its open eyes, sounds are conveyed to its ears; bodies are in contact with its skin; odours reach its nostrils; flavours affect its tongue; but none of the impressions thus made are identified, and consequently are not known. And as it has no knowledge, so it has no will. Its movements are involuntary.

Here is the same child now grown into a man. He has the same organs of mind and body, no more and no less, as when he lay a helpless infant in the cradle; yet his senses are now so acute that he can perceive the slightest differences between the impressions made upon them; he recognises the objects by which he is surrounded; he is familiar *with their* qualities, their parts, their composition, and the

laws to which they are subject; his mind is stored with a wide variety of ideas, some simple and some complex; he is able to summon up these ideas at his will, and to combine them into new groups; and he can express his knowledge and the results of his mental operations in language. He is familiar with events that happened thousands of years ago, and with scenes and objects that he has never beheld. He is able to reason from what he has observed, and from what he has learned through the observations of others. He can devise or employ means to attain what might seem the most unattainable ends. He is, for instance, able to ascertain in his own study the composition of the sun; he can send a message that shall fly with instantaneous rapidity to the ends of the earth; he can control and utilise what might seem to be some of the most unmanageable forces of nature. Simultaneously with this acquisition of knowledge, he has gained the power of directing his conduct under the guidance of his reason; he has formed habits by which his various bodily and mental operations are performed with ease and regularity; his conduct has come largely under the influence of desires and affections; he has a sense of duty and responsibility; he has acquired a knowledge of a world beyond the range of his senses, and of the unseen Creator and Ruler of the universe, whom he worships and obeys, and with whom he holds constant communion.

The purpose of this little treatise will be to trace, in a simple way, the various ways by which the more important of these marvellous changes have been wrought, and to ascertain, in particular, the laws of mental development, with a view to their practical application in education. The teacher has not merely to communicate appropriate knowledge to his pupils, he has to educate them, *i.e.* to *bring out* their latent powers: and all his teaching must be regulated *by what children are.* He cannot impart any *new faculties to them,* or alter the order in which their *faculties are naturally* developed. Even the knowledge *which he communicates* to them they can only grasp and

assimilate in accordance with the immutable laws of the human mind. A little reflection will show the teacher that education does not stand alone in this respect, but that *all* human operations are similarly limited by law. The potter may seem to be able to give what shape he likes to the vessel which he is making, but even *he* is limited in the exercise of his will by the nature of the material in which he works. He cannot deal with clay as though it were wood or marble. He must have regard to the conditions of its plasticity, to its power of supporting its own weight while it is still soft and plastic, and to the effects which the heat of the furnace will have upon it. So the teacher may seem to be able to mould a child as he wills, but, as a matter of fact, he can mould it only in accordance with the laws of its being. He cannot give it a new nature. He can only utilise laws that already exist, and any violation or disregard of those laws is sure to be defeated and punished. He might as well try to make a rope out of sand, or carry water in a sieve, or keep an unsupported stone from falling, as try to successfully defeat the laws of a child's being. All such endeavours are doomed, from the nature of the case, to utter failure, and, in the case of education, must be productive of disastrous consequences. Many a child is ruined for life, and many children are robbed even of life itself, by the errors of parents and teachers that originate in ignorance of the laws of child-life.

Value of some knowledge of human physiology and mental science to the teacher.—It is clear, therefore, that the teacher should know something of the physical and mental laws of the child he is going to educate, not only that he may avoid running counter to nature, *i.e.* to God's intention as seen in natural laws, but *that he may have the momentum of nature on his side.* Systems and methods of education are perfect in exact proportion as they utilise natural laws; and it is the study of these laws which can alone create a science of education.

The teacher who disregards scientific principles must either blindly follow the practice of others, reproducing their methods, whether good or bad, without discrimination, or stumble along from one blunder to another until, at last, he chances on some method that proves to be successful because it *happens* to fall in with natural laws. When he ceases to reason upon the grounds of his practice, he degrades his profession into a mere mechanical craft. Education demands intelligence from the teacher at every stage of its conduct: intelligent observation of the facts of child-life, intelligent generalisations from them, intelligent consideration of the relative value of various kinds of knowledge, intelligent application of principles, and intelligent investigation of the causes of failure or success.

Education an inductive science.—Now the first wish of a young teacher, alive to the importance of studying the science of education, will probably be to procure a book in which the principles of the science of education are clearly set forth; but, while such a book may be of vast service to him, in showing him the kinds of facts which he should observe, and the conclusions which have been drawn from them by writers who have paid special attention to the subject, nothing can compensate the absence of original observation and reflection. Education is an inductive science, and the student of it must observe for himself and reflect for himself before he can attain to a thorough comprehension of its principles, or make a profitable application of them in his daily work. Just as the would-be botanist must not content himself with reading other people's descriptions of plants, or with the examination of diagrams and cut-and-dried specimens, but must go out into the woods and fields and lanes and observe plants for himself, as they live and grow, so must the teacher, who *would be conversant with* the science of education, make *himself thoroughly familiar*, at the first hand, with the facts *of child-life. He must* watch children when they are left to

themselves; he must note the ways in which they amuse themselves, remembering that *play* is to them their most earnest occupation; he must observe their primitive instincts, and how those instincts are naturally gratified; he must pay special heed to the ways in which they, consciously or unconsciously, become acquainted with the facts of the world around them; to their first endeavours at speech, as reflecting the operations that are passing through their minds; to their questions; to the order in which their faculties develope; and to the motives which exert the most powerful and healthy influence upon their conduct. He need not go far to find fitting objects for his study. Any little child into whose confidence he can, by love and sympathy, insinuate himself, will afford him infinite room for observation and reflection, which he will be able to turn to profitable account. When no other mind is at hand, let him observe and interrogate his own. Let him ask himself the means by which he came by this idea or that; how he remembers this, and why he has forgotten that; what faculties he employs in one operation, and what in another; why, in his own studies. one method of learning succeeds and another does not, and so on.

He will find that though this subject may seem hard and dry in a book, it is fraught with interest when the mind is kept constantly in contact with living facts. He will find, too, that though he may not see at once the practical application of the truths which he in this way acquires, they will gradually affect his teaching. In order to obtain the command over Nature, he will obey her. He may not discover any new method of teaching, although there is much more yet to be done than most people imagine to bring our systems of teaching into accord with natural laws; but he will inevitably teach more intelligently, whether he pursues judiciously selected *old* methods or strikes out *paths of his own,* for the simple reason that he knows what he is doing, *and why he is* doing it.

CHAPTER II.

THE SENSES.

ALL our knowledge of the world around us is derived, in the first place, from the evidence of our senses, which have been happily named 'the five gateways of knowledge,' and it is with the cultivation of the senses that education must begin. 'The famous town of Man-soul,' says John Bunyan, 'had five gates, in at which to come and out at which to go, and these were made likewise answerable to the walls,—to wit, impregnable, and such as never could be opened nor forced but by the will or leave of those within. The names of the gates were these: Ear-gate, Eye-gate, Mouth-gate, Nose-gate, and Feel-gate.'

Let us, before we proceed any further, examine these gateways; and here it may be remarked that we shall learn a great deal of the way in which a child gets its ideas by observing how we adults get our own.

Taste.—The sense of taste enables us to distinguish one kind of food from another, and to ascertain, to some extent, whether the food we eat will agree with us or not. Its organ is the tongue, which has distributed over its upper surface little projections connected by nerves with the brain. The most sensitive parts of the tongue are its base, sides, and tip.

Ideas derived through the sense of taste.—Tastes may be classified (1) with regard to the stomach, as palateable and unpalateable; (2) with regard to the taste proper, as sweet or bitter; (3) with regard to certain effects which

they have on the nerves of touch, as acid, alkaline, saline, astringent, biting; and (4) with regard to certain classes of objects with which they are commonly associated, as watery, vinous, spicy, chalybeate.

Nearly every article of food has a distinct flavour which enables us to recognise it, if it be familiar to us; or to detect its presence, if it be unfamiliar to us, by the taste alone. Solids do not readily yield their flavour until they are moistened, and the tongue itself loses its sensibility when it is dry and parched.

It is not known *how* flavour affects the nerves of the tongue; but it is probable that it is through some chemical action.

The sense of taste may be highly cultivated, as we see in the case of persons whose business it is to taste wines and teas. An inexperienced person would find some difficulty in distinguishing one sherry from another, but a wine-taster will not only distinguish them, he will tell you, perhaps, the precise district from which they came, and the very year in which they were made.

But the sense of taste cannot be made much use of in formal education. 'Helpless, selfish and exacting, the dependent of the other senses, and the servant of the *body* rather than of the *soul*, it links us more with the lower animals than with higher existences, and has no elements of ethereality about it.'—(Dr. G. Wilson).

Smell.—The sense of smell enables us to discriminate the air taken into the lungs, just as the tongue, which has been called 'the stomach begun,' enables us to discriminate the food taken into the stomach. Its organ is the nose, which is lined with a soft, moist, velvety membrane, connected by nerves known as the *olfactory nerves* (from Latin, *olfacio*, to smell), and by branches of another nerve known as *the fifth*. It is on the former that *odours proper* act; on the latter act *pungent vapours* such as hartshorn, strong acids, etc.

Ideas derived through the sense of smell.—Odours may be classified (1) with regard to the lungs, as fresh, close, exhilarating, stifling; (2) with regard to the smell proper, as sweet, offensive, nasty; (3) with regard to the nerves of touch, as pungent, acrid, etc.; and (4) with regard to certain objects and processes with which they are most commonly associated, as fishy, briny, spicy, cheesy, musty, rotten, etc. The mode in which the organ of smell acts is unknown. All we can say is that the air brings the volatile odorous matter into contact with the various branches of the nerves of smell, and that in some way or other these nerves convey the impression to the brain.

The sense of smell is more highly developed in many of the lower animals than in man; but even in man it is capable of a high degree of cultivation, as we may see in the case of persons whose business it is to distinguish nice differences of odour. The tobacco-dealer, the botanist, the wine-dealer, and the perfume-maker can detect differences of odour which ordinary people could not perceive.

The sensations of smell are very marked whilst they last, but they are, comparatively speaking, rare and transient. The odours which produce them are all of a gaseous or volatile nature, and, for the most part, quickly pass away.

Touch.—The organ of touch is the skin, which contains under the cuticle little projections called papillæ, connected by nerves with the brain. These papillæ are spread over the whole surface of the skin, but are most numerous on the tips of the fingers, the palms of the hands, and the soles of the feet. The sense of touch operates by *pressure* or *simple contact.*

Ideas derived through the sense of touch.—The *sense of touch enables* us to ascertain the form, surface, *and temperature, and*—*in* combination with muscular feeling

—the resistance, weight and pressure, of bodies submitted to it. Sensations of touch may be classified (1) with regard to the pleasure or pain which accompanies them, as agreeable, disagreeable; (2) with regard to the peculiar feelings produced by different temperatures, as hot, cold, lukewarm, chilly; (3) with regard to various peculiar sensations of the skin produced by the action of external bodies, as chafing, pricking, fretting, tickling; (4) with regard to singularity or plurality of points of contact; (5) with regard to pressure, as heavy, light; (6) with regard to resistance, as hard, soft, firm, yielding, solid, liquid, elastic, plastic; (7) with regard to surface, as rough, smooth, wavy, dimpled, pitted; and (8) with regard to extension,[1] as straight, curved, crooked, square, oblong, triangle, cube, pyramid, sphere, etc.

Some of these ideas are of such vast importance in mental development, that it may be worth while to examine into them a little more closely.

Plurality of points of contact. — A distinctive feature in the sense of touch, as compared with taste and smell, is the consciousness which may accompany it of a plurality of points; *i.e.* of an extended surface in the object submitted to it. A taste or an odour presents itself to us as a whole and undivided sensation, although it is really not so, the separate sensations occurring so closely together that we are not conscious of their separation; but touch may afford us a *manifold* sensation. Smell a rose and the sensation is single; place your hand on the bristle side of a hair-brush, and you are conscious of a multiplicity of separate points. You experience the same sensation, in a less degree, when you place your hand on a smooth surface.

This simultaneous consciousness of a plurality of points helps to give us ideas of extension, form, and surface. Feel

[1] Extension is that property of matter in virtue of which it occupies *space. It relates* to the qualities of dimension, viz.: length, breadth, *and thickness*; and may be classified as linear, superficial, and cubical.

a body that can be covered by the hand,—or, still better, by the finger,—and you can tell fairly well by touch alone what is its shape, and what is the character of its surface: you can tell whether it is round, or square, or oval; and whether the points on its surface are many or few, sharp or blunt. These discoveries are, of course, facilitated by moving the hand over and around the bodies examined; but here muscular feeling comes to the assistance of touch. We judge of the outline and surface partly by the resistances we experience in passing our hands over them.

Pressure, resistance, and weight. — When a weight rests upon any portion of the skin we are conscious of a compression of the part of the body affected by it. If the part of the body be unsupported, we are further conscious of an expenditure of muscular energy. For instance, if a weight be placed on your outstretched hand when it rests upon the table, you are conscious of a pressure proportionate to the weight; if your hand be not supported, you are further conscious of an effort expended in sustaining the weight. The degree of pressure, and the amount of energy expended, enable us to roughly estimate weights. 'Weber found that the tips of the fingers [the hand being supported] could discriminate between 20 ozs. and 19.2 ozs., and the forearm 20 ozs. from 18.7 ozs.' (Bain.) An ordinary person can discriminate with the unsupported arm between 39 and 40 ozs.

But we are mainly indebted for our ideas of pressure, resistance, and weight, to the consciousness that accompanies *muscular* effort. That consciousness informs us (1) of the *degree* of the effort; (2) of the *time* during which it lasts, in the case of muscular movements; (3) of the *space* through which the effort is made; and (4) of the *speed* with which it is made.

Extension.—*When* we move our hand over an object *we are conscious (1) of a* plurality and a succession of points

in the object, and (2) of the expenditure of a certain amount of muscular energy in passing from point to point. This plurality and continuity of sensations of touch, together with simultaneous muscular efforts and visual impressions, help to give us our ideas of extension and form.

A blind child might have distinct ideas of extension. By passing its finger along the edge of a ruler, it might get the idea of linear extension, *i.e.* of a continuous succession of points in a line. By extending its hand over the surface of a slate it might get the idea of superficial extension, *i.e.* of the continuous succession of points presented by the same body in two different directions. By extending the hand over the sides and back of a book it might get an idea of cubical extension. The flexibility of the fingers, enabling the hand to close round a body, and the possession of two hands, enabling us to touch two sides of a body simultaneously, greatly facilitate the acquisition of ideas of cubical extension.

Form, size, situation, distance and direction are only various modes of extension.

Ideas of **form** may be derived from noting (1) the succession of points presented to the touch in following the outline of an object, and (2) the muscular efforts simultaneously required to direct the hand.

The **size** of an object cannot be precisely determined by the sense of touch. A hole in a tooth, that would be scarcely perceptible to the finger, seems a considerable cavity when touched by the tip of the tongue. The points of a pair of compasses, when drawn over the skin, will seem to widen or contract according as they are drawn respectively over the more or less sensitive parts of the skin. Ideas of size may be obtained by noting the muscular effort required in passing the hand round the bodies examined, and comparing it with the times occupied in the process.

Ideas of **distance** may be obtained from the amount of

muscular effort required in (1) passing the hand from one extremity of the distance measured to the other; or (2) in going from the one point to the other; or (3) in directing the eye from one point to the other.

Ideas of **direction** and **situation**, *i.e.* of place relatively to ourselves and to other things, may be derived from noting the particular muscular efforts needed to pass from one point to another. For instance, I am conscious of employing one set of muscles in passing my hand from my body to this page, and of another set in passing from the top of this page to the bottom.

It might seem to the young student that the origin of some of these ideas might be more easily accounted for by referring them to sight rather than touch; but, as we shall see hereafter, many properties of things which we seem to see directly with the eye, we really learn *by a comparison of the impressions made by sight and touch.* It will, of course, be remembered that a child often employs different senses simultaneously on the same object, and is in this way enabled to compare and combine the impressions made by them. For instance, it *sees* a ball at the same time that it *feels* it, and gradually associates the distribution of light and shadow on its surface with the sphericity perceived by touch, until at last it seems to see directly the sphericity itself. As a matter of fact, we do not immediately see what is called tangible form, *i.e.* cubical extension; we see only linear and superficial extension, and reason as to the actual form of a body from the distribution of light on its surface. The sense of touch may be highly cultivated. The blind man reads by passing his fingers over the characters of an embossed page; the miller tests the fineness of his flour with his thumb; the physician follows the nicest variations of a patient's pulse with his fingers. Professor Upham mentions the case of a blind girl, in Hartford Asylum, who, when the baskets of linen were brought from the laundress, was able to select her own

articles without hesitation, no matter how widely they were mixed up with those of other people.

Hearing.—The organ of hearing is the ear, a complex instrument, of which the so-called ear is but the outer porch. Its mode of action is as follows:—When material bodies are struck or otherwise violently disturbed, they are thrown into a state of vibration. This vibration is communicated to the surrounding air, the vibrations of which ultimately enter the outer ear, and strike upon a membrane called the tympanum. The vibrations of the tympanum are communicated to a series of bones extending to another membrane, viz., that of the labyrinth or internal ear, and are then transmitted, by the consequent compressions of a liquid inside the labyrinth, to the auditory nerve.

Ideas derived through the sense of hearing.—Sounds may be classified with reference to (1) the pleasure or pain they afford, as pleasant, sweet, harsh, jarring, discordant, melodious, harmonious, etc.; (2) their intensity, as loud, soft, waning, waxing, etc.; (3) their pitch, as high, low, shrill, etc.; (4) their occurrence in time, as sudden, long, intermittent, sustained, irregular, fitful, rhythmical, etc.; (5) their distinctness, as clear, impure, muffled, etc.; (6) their purity, as true, false, sharp, flat; (7) their articulateness, as distinct, indistinct; and (8) with regard to various objects with which certain acoustic peculiarities are familiarly associated, as metallic, wooden, hollow, solid, liquid, brassy, tinny, etc. It is worth noticing that large numbers of words referring to sounds are imitative, *i.e.* they have been coined to imitate the sounds; *e.g.* crash, dash, splash, bump, bang, crack, roar, mew, jingle, jangle, jar, thud (the sound produced by a heavy body falling from a great height to the ground), whiz, cluck, quack, ping (the sound of a rifle-ball passing through the air), whir, buzz, hum, hush, patter, etc. Words of this class, not being arbitrary coinages, are among the earliest children learn, and are often coined by them.

The **distance** of a *known* sound is inferred from its intensity as compared with its known intensities for known distances. The *distance* of *unknown* sounds can only be roughly calculated by comparison with known sounds to which they bear some likeness. In neither case is the distance heard. It is inferred.

The **direction** of a sound is inferred from the varying intensity of the sound as presented to our two ears, or according as we have to turn our head to right or left, up or down, to hear it more distinctly.

The sense of hearing is more susceptible of education than that of sight, and it can be developed more quickly. Infants at a very early stage delight in melodious and rhythmical sounds, as we may see from the pleasure which they take in the lullabies of their mothers and nurses, in nursery rhymes, in the measured sound of marching, and in all forms of music. It is the opinion of the highest musical authorities that every child could be taught to sing and to enjoy music, if taken in hand at a sufficiently early stage. To what a high degree of cultivation the ear may be brought may be seen in the case of the conductor of an orchestra, who, with hundreds of performers before him, can not only detect any false note, but single out the part in which it occurs. Not less marvellous is the rapidity with which infants learn to analyse and reproduce the marvellous intricacies of articulate speech. Of all the senses hearing is the sense 'which most readily and most largely lends itself to the impassioned, emotional, or, as we otherwise name it, poetical or æsthetical feeling.'—(Dr. G. Wilson).

Sight.—The organ of sight is the eye, which has been described as 'a compound optical lens in communication with a sensitive surface.' (Bain.) The mode of its action is as follows :—The rays of light proceeding from any object that is looked at are so refracted on entering the pupil of *the eye as to form an inverted* image of the object on the

retina. The object, in order to be seen, must be at or beyond a certain distance from the eye. If it be within the distance the rays will converge behind the retina, instead of upon it. The eye has a power of adjustment by which it is enabled to adapt itself to the varying distances of objects. The two eyes are made to converge for near objects, and a different image is formed on the retina of each, the two images being unconsciously mentally compounded. Thus, if I hold a book on the tips of my fingers at a distance of about five or six inches from my nose, and look at it alternately with my right and left eye, it seems to shift its position to the left and right alternately. When I look at it with *both* my eyes, it assumes an intermediate position, and presents an appearance different from that which is beheld by either eye when the other is closed.

In looking at distant objects, the eyes preserve their parallelism. The muscular efforts involved in these various adjustments is of assistance in determining the *distance* of objects that are looked at. We are also largely assisted in estimating the distance of objects by the degrees of distinctness of their outlines and colours, compared with certain standards for known objects. We do not *see* the distance; we infer it.

Ideas derived from the sense of sight. — The objects of sight may be classified with regard (1) to the sensations, or the peculiar feelings which accompany them, as soothing, blinding, dazzling, etc.; (2) to light, as luminous, dark, shadowy, dappled, flecked, etc.; (3) to colour, as of red, blue, yellow, etc.; (4) to lustre, as bright, dull, brilliant, dead, glittering; (5) to movements, as stationary, dancing, steady, moving, undulating, unsteady, etc.; (6) to visible form, as straight, zigzag, curvilinear, square, oblong, triangular, circular, oval, etc.; (7) to size, as large, small, vast, enormous, infinitesimal; (8) to distance, as near, *remote, distant;* (9) to situation, as east, west, north, south;

(10) to typical objects with which peculiar visual impressions are familiarly associated, as solid, liquid, icy, glassy, golden, silvery, emerald, steely, coppery, slaty, fishy, etc.

Colour is not an essential quality of bodies, as solidity and extension are, but a secondary quality,[1] like temperature, smell, and taste. It is produced by the action of certain qualities of objects upon the eye, and the effect varies with the eye acted upon. Some persons, like the celebrated Dalton, are insensible to certain differences of colour.

Movement.—We are rendered visually conscious of the *movement* of an object by the muscular effort required to follow it, as when we follow the flight of a bird, and by noting its varying distance from objects that are stationary.

Superficial Form.—We perceive superficial form visually by a simultaneous or continuous consciousness of the visible points which, in their continuity, make up its surface, and also, if the object looked at be large, by the muscular efforts which accompany the process of following its outline. The movements of the eyeball are much more frequent than is commonly believed. Read with one eye and feel the sympathetic movement of the closed eye, by putting the finger on the lid, and you will be conscious of the constant shifting of the eye in reading along even a short line of

[1] The qualities of material objects are divided into primary and secondary. The primary qualities are such that we cannot conceive bodies to exist without them. Such are extension and solidity. They exist outside the mind, and might continue to exist even if there were no sentient beings to perceive them. The secondary qualities of material objects are such as are not essential, and yet have the power of producing sensations in a sentient being. Such are colour, taste, smell, temperature, etc. The young student should notice that words denoting these qualities are used in two senses, viz. (1) to denote the *quality in the object* producing sensation, and (2) to denote the *sensations produced by the quality*. Thus heat may denote (1) a quality in fire, or (2) the effect which such quality has upon a sentient being.

print. Similarly, in looking at a landscape, we do not see the whole of it at once, but shift the vision from point to point. We are dimly conscious of the whole; we see distinctly only a part at a time.

Solid form.—We visually perceive solid form partly by combining the consciousness of muscular effort required to follow with the eye its three dimensions, with certain remembered coincidences of muscular efforts and tactile sensations, and partly by associating the distribution of light on the surfaces of the object with past tactile sensations produced by the same object, or by similar objects. The light, for instance, on a cube is unequally distributed. The top may be in a bright light, the front in a light less intense, and the third visible side in a deep shadow. If we pass the hand over the cube, we notice the coincidence of the various lights on the three visible planes with the altered directions of the hand. It is by associating the modes in which the light is distributed over objects with past tactile and visual experiences that we recognise the form of solid objects represented on a flat picture. We, as it were, interpret the visual impressions by remembered tactile impressions. The eye is easily deceived by representations of solid form, and would be entirely deceived if the representation were perfect. Even in a room not very lofty the sham painted cornice often looks so like an actual projection as to be scarcely distinguishable from one. The poet Young had a sham seat painted in his garden, which visitors used to walk up to before they discovered the cheat. It bore the appropriate motto, 'Invisibilia non decipiunt.' (The invisible does not deceive).

Persons who have suffered from congenital cataract, and have had the cataract removed, see objects, at first, as though they were perfectly *flat*, like a picture, and it is only by slow degrees that they learn to associate the new visual impressions with the old tactile ones. A boy who had been blind from birth, and acquired sight by an operation per-

formed on him when he was twelve years of age, was well acquainted with a dog and cat which he used to play with, but he could not distinguish which was which, when he first saw them, without taking them up and feeling them.

The sight may be highly cultivated. The sailor can see a distant ship long before the inexperienced landsman. The artist can perceive slight differences of form and colour, and light and direction, which the untaught eye cannot. 'The Esquimaux can discover a white fox amidst the white snow; the American backwoodsman will fire a rifle-ball so as to strike a nut out of the mouth of a squirrel without hurting it; the Red Indian boys hold their hands up as marks to each other, certain that the unerring arrow will be shot between the spread-out fingers; the astronomer can see a star in the sky, where to others the blue expanse is unbroken; the shepherd can distinguish the face of every sheep in his flock; the mosaic worker can detect distinctions of colours where others can see none.' (Dr. G. Brown.) The visual perception of children at first is very imperfect, as we may see from their early attempts at writing and drawing. They will, for instance, often make an S thus Ƨ, and will fail to perceive the inaccuracy even when it is pointed out to them. And even later in life, there are many persons who cannot strike a nail on the head or draw a straight line, or tell whether a line is vertical, or horizontal or not, or whether the lines of a building seen in perspective go up or down, or dispose the ornaments on a mantelpiece with some approach to symmetry. This partial blindness (for such it may be considered) might in all cases be cured by judiciously devised exercises.

Organic sensations.—In addition to the sensations of taste, smell, touch, hearing, and sight, we have another class of sensations connected with our *muscular* system, our *nervous* system, our *circulation* and *nutrition*, our *respiration*, our feelings of *heat and cold*, and with the *alimentary canal*.

Such are the pains occasioned by over-straining or otherwise injuring the muscles; the pain of fatigue, the pleasure of repose; the exhilaration produced by the action on the nerves of stimulants, the depression that follows nervous excitement; hunger and thirst; the discomfort that arises from long continuance in any one posture; the freshness that accompanies the breathing of pure air; the sense of suffocation that arises from the want of air, from asthma, and from certain gases; sensations produced by heat and cold acting on the circulation and respiration; relish, disgust, etc.

Definition of sensation.—We are now in a position to define sensation. A sensation is the impression made on the mind by the action of some external object on a part of the body, or by the action of one part of the body on another part.

Sensations are to be distinguished from *muscular feelings*, which are produced by the consciousness of the possession of energy, or by the expenditure of energy in work done; and also from the *emotions*, which, though they may be excited by external agencies, are not produced by contact between external objects and the sensitive surface of the body.

Each sense has its own function.—The senses have distinct provinces assigned to them, though in some cases the impressions made on different senses may lead to the same conclusion. Thus, I may feel that a ring is round by passing my finger round it, or I may see that it is round. But the sensation which I derive through my touch bears no resemblance to the sensation derived through my sight. Hence no skill on the part of the teacher, and no amount of illustration or description, can convey to a child lacking in a sense any notion of the sensations conveyed by that sense. No description, for instance, could make a blind child understand what was

meant by red, or a deaf child what was meant by music. A blind man on being asked what red was, is reported to have replied that it was something like the sound of a trumpet!

Each sense must be independently exercised before any notion can be formed of its proper sensations. The gateways of the mind open only to their own particular class of acts, and are rigidly closed to all others. Still less can mere words convey notions of new sensations.[1]

Comparison of services rendered by the senses. It is to be noted that the senses vary very considerably in the extent to which they contribute to furnish the mind with ideas. Thus taste and smell, although they are sources of much pleasure and pain, and render invaluable services to us, as door-keepers to the stomach and lungs, are restricted to a small class of objects, and the permanent impressions which they leave on the mind are comparatively feeble. Large numbers of objects with which we are familiar through our other senses we never dream of tasting, and a still larger number have no odour which we are capable of smelling. Again, though we can recall with ease the pain or pleasure which accompanied past sensations of taste and smell, it is only with difficulty we recall the sensations themselves, when the objects which produced them are no longer present. Thus I can vividly recall the form and colour and surface and parts of a rose; but I have considerable diffi-

[1] Teachers sometimes overlook this fact, and imagine that because words describing sensations can reach the mind, notions of the sensations must reach it also. Words can revive the idea of a past sensation, but they cannot impart the idea of an entirely new sensation. Real knowledge must be acquired, either directly or indirectly, through the exercise of the senses which are affected by the objects of knowledge. We must see what can be learnt by sight only; we must touch what can be learnt by touch only, and so on. Teachers often take *their knowledge to the* wrong gateway, and sometimes disregard the *gateways altogether. They* might as well try to give a child an idea *of a picture by getting him* to smell it.

culty in recalling its fragrance, although I could immediately identify the odour if it were presented to me.

Sight, touch, and hearing are the senses to which we are indebted for the larger number of our ideas; and the ideas which originate with them are the most vividly stamped upon the mind. Hence they are sometimes called the *intellectual senses*. It is with these education is mainly concerned.

CHAPTER III.

HOW THE CHILD GETS HIS FIRST IDEAS.

We will now return to the infant whom we left lying in the cradle, and inquire how the impressions made upon his senses will convey notions to his mind.

At present he knows nothing. His senses receive various impressions of light, warmth, colour, sound, taste, resistance, etc., but he does not as yet distinguish them, and, of course, cannot identify them. All you can say of his present condition of mind is, that it is possessed by a diversified consciousness. The first exercise of his mind will occur when he becomes conscious of some *change of feeling*, such as would be produced by the striking of a clock, or by the sudden bringing of a bright light into a darkened room.

The consciousness of unlikeness between different sensations.—A continuous impression made upon the infant's senses would not be noticed, for there would be nothing to direct attention to it. If, for instance, the heat or light of the room in which he lives never varied, he would not notice them. He would first notice the sensation of heat on some change of temperature, as from heat to cold, or from cold to heat. He would first notice the sensation of light on some transition from light to darkness, or from darkness to light.

'The first dawn of intelligence consists in change of feeling, by which *differences* begin to be recognised. Mind commences in this perception of differences; it cannot be *said that we know anything of itself*, but only the differences *between it and other things.*' (Miss Youmans).

The consciousness of likeness between different sensations.—When the child has a second experience of the same sensation he will be conscious of some resemblance between the two. This consciousness of likeness will be deepened with each repetition, so long as his attention is drawn to the likeness. The impression made by the sound of the clock-stroke will grow familiar to his mind. The impression made by the light of the candle will come to be recognised at each recurrence of it. In this way, through the simultaneous perception of differences and resemblances between the impressions made upon his senses, he will gradually come to distinguish (1) the impressions made upon different senses, (2) the impressions made upon the same sense. He will mentally separate sight from sounds, and one sight or sound from another, and so on.

Repetition essential to the formation of clear ideas and to their retention.—Before an idea can become clear, and be permanently retained by the mind, it must be repeated. The first time the child hears a voice break the silence he will notice the difference between his present and previous state of feeling; but as soon as the sound has died away he will have but a very imperfect recollection of the sound, because there is nothing to link on to it, except, perhaps, the contrast with the previous stillness. The second time the voice is heard he will, with more or less certainty, recognise it. If we could imagine him gifted with the power of speech he would say, 'This is like what I felt before.' Each time the voice is heard anew the consciousness of likeness and unlikeness will be repeated, and the impression produced by the voice upon the mind will be deepened, until at last it will be permanent. The child will know it. He will be able to recall it even when the voice is not heard.

Association of ideas.—Mere repetition may suffice *to fix an idea* in the mind, but the association of sensations

with pleasures and pains, the association of impressions made on the same sense, the association of impressions made on different senses, and many other associations contribute still more powerfully to produce this result. The repetition, as it were, engraves the idea more and more deeply in the mind; the associations keep constantly directing our attention to the original record, and bringing it into consciousness. In this way each idea serves to render more vivid and more easily remembered each associated idea. Just as the repetition of ideas leads to the permanent retention of ideas, so the association of ideas serves to revive and brighten them by bringing them into conscious remembrance. It multiplies the occasions on which old ideas are brought under review. What is called *remembering* is merely the directing our consciousness to some present record in the brain of an old impression. We do not recall the actual original impression, but bring under review what remains of it, the link by which this is done being some impression or train of impressions so associated with the old impression as to be capable of reviving it.

The brain the instrument of the mind. — *How* ideas are lodged in the mind we do not know. All we can say is that the brain is the instrument of the mind; that no sensation can be conveyed to it without in some way or other physically affecting it; that similar sensations are likely to affect it in the same way and in the same part; that different sensations are likely to affect it in different ways and in different parts; and that a series of sensations are likely to produce in it a corresponding series of effects linked together as their causes were. Of this we are absolutely sure, that the brain, like every other material object, is a permanent record of every force that acts upon it. Nature records in the altered constitution of things everything that happens to them. Every operation of the mind, like every action of the body, is accompanied by physical changes, and these

changes are the permanent register of both. There is really no greater difficulty in understanding how the mind is conscious of the permanent results of an old impression on the brain, than of the immediate results of a present impression.

It does not follow from this that the brain *is* the mind; what is said is that every mental operation is performed *through* the brain, and is accompanied by some permanent modification of the brain. Again, we must not imagine that the impressions left upon the nervous matter of the brain bear any resemblance to the objects which, acting upon the senses, originally produced them. An effect does not necessarily resemble its cause. The image formed upon the retina of the eye is an exact representation of the object producing it, except that the image is inverted, but the sensation conveyed to the mind is not a visible impression resembling the image upon the retina. The slightest consideration of this fact would remove the difficulty which some people find in understanding how it is we see bodies erect, when their images on the retina are inverted. The real difficulty lies in understanding how the physical impression is converted into the mental, not in the correction of the retinal inversion. We have no knowledge whatever of the nature of the changes produced in the brain by sense-impressions; though we are absolutely certain that there must be changes produced in it of some kind or other.

Conditions under which sensations give rise to ideas.—It will be gathered from what has been stated that the conditions under which sense-impressions are converted into knowledge, are—

(1) The perception of *unlikeness* between different sensations.

(2) The perception of *likeness* between different sensations.

(3) The *repetition* of sensations.

Simple as this analysis may be, it applies to all our ideas that are derived through our senses. Indeed, the perception of likeness and unlikeness lies at the bottom of *all* our mental acquisitions.

'Whatever the object of thought, to know in what respect it differs from all other things, and in what respect it resembles them, is to know all about it—is to exhaust the action of the intellect upon it. The way the child gets its early knowledge is the way all real knowledge is obtained. When it discovers the likeness between sugar, cake, and certain fruits, that is, when it integrates them in thought as *sweet*, it is making just such an induction as Newton made in discovering the law of gravitation, which was but to discover the likeness among celestial and terrestrial motions. And as with physical objects, so also with human actions. The child may run round the house, and play with its toys; it must not break things, or play with the fire. Here, again, are relations of likeness and unlikeness forming a basis of moral classification. The judge on the bench is constantly doing the same thing; that is, tracing out the likeness of given actions and classing them as right and wrong.' (Miss Youmans).

The young teacher will do well to constantly bear in mind this fundamental law of the human mind. No matter what the subject of his lesson may be, he will find that it mainly turns upon the perception of points of difference and agreement; and that his success as a teacher will largely depend upon his skill and persistence in setting forth these points. Very frequently he will have to show that under a superficial identity there are points of difference, and that under what might seem, at first, the widest possible divergences, there is an essential agreement. He will also have to take cognizance of the very different degrees of ability to recognise points of agreement and difference which children *possess. Some children* are quick to detect resemblances; *others to detect differences.* As a rule, they are more alive

to differences than to resemblances. In teaching the alphabet the letters that give most trouble are those which nearly resemble each other, e.g., *b* and *d*, *c* and *e*, *p* and *q*, *n* and *u*.

There is scarcely a subject of school instruction which does not allow the teacher to utilise associations of resemblance and difference. Thus, in *geography*, the teacher might compare the eastern and western hemispheres, the torrid and frigid zones, the land and the ocean, the E. and W. shores of the Atlantic, Lancashire and Kent, London and Paris, Ceylon and Madagascar, the exports of Russia and Spain; in *history* he might compare the Roman Invasion and the Saxon Invasion, life in England in the sixteenth century and the nineteenth, domestic life before the Conquest and after it, Henry V. and his son, Marlborough and Wellington; in *physical science* he might compare magnetic and electric polarity, acids and alkalis, reflection and refraction, light and heat, fog and dew, chlorine and sulphur, etc.

The sharper the contrast, or the more strongly marked the unity under seeming diversity, the deeper the impression made on the mind.

The perception of likeness and unlikeness involves *attention* to our sensations. On this subject see 'Discipline and the Formation of Habit.'

CHAPTER IV.

HOW THE CHILD PERCEIVES.

SENSATION has been defined as the mental impression which is produced by the action of external objects on some part of the body. At first the mind is not conscious of the existence of the objects by which these sensations are produced; it *feels* the effect, but does not *perceive* the cause. The mind of a new-born child is entirely ignorant, not only of the world around it, but that there is a world external to it. It is completely isolated. It has sensations, but the sensations are not connected with the external objects which produce them. 'To it the inward world is everything; the outward world is nothing.' (Dr. Morell).

The recognition of the quality in an object which produces a sensation is what is termed *perception*. By degrees the infant learns to refer its sensations to the objects producing them, and thus acquires a knowledge of a world external to himself. This perception of outwardness grows as the mind becomes capable of *associating certain sensations with the presence of certain objects, and the cessation of those sensations with the absence of the objects.* When the infant first hears the clock tick he does not know whence the tick proceeds. He is only conscious of a sound. By degrees he finds from which side the sound proceeds; then from what object; then under what conditions of the object, and so on.

***Perception* subsequent to sensation.**—It is important to observe that the mind is *immediately* conscious

of sensations only, and that the perception of the external objects which produce them is a subsequent act. The direction of a ray of light leads the mind to perceive the object whence it proceeds; the side on which a sound is best heard leads it to perceive the source whence it proceeds; the power we possess of referring sensations of touch to the particular part of the body affected directs the mind to the object in contact with it: the pleasures and pains connected with taste and smell are still more directly associated with the objects producing them.

All perceptions based on experience.— Most of our perceptions are acquired so early, and are at last repeated so rapidly, as to seem intuitive; but various experiments appear to prove conclusively that they are all inferences from experience. Dr. Carpenter says of a little boy who, at the age of three, had been cured by an operation of congenital cataract, that, 'though he clearly recognised the *direction* of a candle or other bright object, he was unable as an infant to apprehend its *distance*; so that when told to lay hold of a watch, he *grasped* at it just like a young child lying in its cradle. It was *very gradually* that he came to use his sight for the guidance of his movements; and when going about the house at which he was staying in Bristol, with which he had familiarised himself before the operation, he generally *shut his eyes*, as if puzzled rather than aided by them. . . . When he returned *home* to his father's house and farmyard, his parents (very intelligent people) remarked that he was for some time obviously puzzled by his sight, *shutting his eyes* as he went about in his old way; though whenever he went to a *new* place, he was obviously aided by it. But it was several months before he came to trust to it for his guidance, as other children of his age would do.'

The various steps which are taken in arriving at a knowledge of an external object would appear to be—

(1) The consciousness of a sensation.
(2) The reference of the sensation to some external cause.
(3) The formation of a notion of the object, or quality in the object, by which the sensation is believed to be produced.

Simple and complex notions.—Our notions of external objects are simple or compound according as one or more sensations is referred to them. Thus, our notions of colours, tastes, and smells, are for the most part *simple*. Our notions of bodies perceived to affect our senses in a variety of ways, are *compound*. It is obvious that the notions which different people have of the same object are not necessarily co-extensive: one person may perceive in an object only one quality; another two; another three, and so on. A child's notion of an orange is compounded of the simple notions of its colour, form, size, roughness, odour, taste, parts, etc. A botanist's, chemist's, or artist's notion of it, would be much more extensive.

Notions derived from reflection.—In addition to our notions of external objects we have notions of our own mental operations and states. These are derived from directing our consciousness to the mind's own condition. I not only perceive a rose, but I am conscious that I perceive it. I not only feel pain, but I am conscious that I feel it. We, as it were, perceive ourselves thinking, reasoning, feeling, loving, hating, envying, and so on. So that the inmost recesses of our nature have a character of outwardness stamped upon them when considered with reference to the mysterious 'I' which they enfold.

Attention indispensable to perception.—Attention is as necessary to perception as to sensation. Indeed, it is the indispensable condition of all conscious mental operations. We often speak of persons possessing 'a good

eye,' or 'a good ear,' as having 'an eye for nature,' or 'an eye for colour,' or 'an eye for a horse,' and so on; as though the faculties so described were purely original gifts of nature. To a large extent they undoubtedly are original; but to a still larger extent they are the result of paying careful and sustained attention to a particular class of objects. One person gives a cursory glance at an object and carries away a very meagre and imperfect impression of it. Another looks at it carefully and frequently, and exhausts the sensations which it is capable of affording. The mechanical apparatus of the eye may have been originally as good in the former case as the latter, and may be still as good for the observation of another class of objects; *the main difference is not in the eye but in the mind behind it.* The unobservant man looks but does not see; the observant man looks till he does see.

Effect of expectancy on perception. — There is also a reactionary influence exerted by the mind on the senses which should be noted. When once the mind has experienced a sensation and perceived its cause, an expectancy is created that the sensation will be reproduced when the object is again presented to the sense that has been affected by it. We *look out* for the old sensation and the cause to which we have assigned it. Thus the eye to a large extent sees, and the ear hears, and the nose smells, and the tongue tastes, and the skin feels, what they bring with them the power to see, and hear, and smell, and taste, and feel. We bring our past experiences to bear on our present sensations.

Of the dull, unobservant hawker, the poet says:

> 'A primrose by a river's brim
> A yellow primrose was to him,
> And it was nothing more.'

A naturalist would see in the primrose an illustration of hundreds of truths taught him by his previous studies. A

poet would see in it forms of beauty associated with an infinite variety of pleasurable ideas.

Observing faculties strengthened with exercise.—The observing faculties, like all our other faculties, are sharpened with exercise, the physical organs involved in their exercise having a power of *growing to* the special work upon which they are engaged. This power is strongest in childhood. The rational faculty not having been yet developed highly, almost the whole attention is concentrated upon the sensations and the objects producing them. The absence of reflection gives us opportunities to observe. Hence, in childhood, the mind should be mainly exercised in gaining a knowledge of the external world through the employment of its senses, and in learning to describe its sense-impressions, this knowledge being not only that best suited to the stage of development which it has reached, but the foundation of all other knowledge. Even the 'invisible things' of God are understood by 'the things that are made.' (Rom. i. 20).

CHAPTER V.

HOW THE CHILD FORMS CONCEPTIONS.

THUS far we have endeavoured to account for the acquisition of our notions of particular sensations, and of objects as causing those sensations. We have now to inquire how we come by those conceptions which have no external objects precisely corresponding to them,[1] and which are designated by general names, or, as they are called in grammar, by *common nouns*. A child knows, we will suppose, the oak tree in the front of the house and the holly tree at the back of the house; but, as yet, he knows them only as individual trees. He does not perceive under their wide diversity of appearance certain points in common. By and by he will see that they both have trunks, branches, leaves, bark, roots, etc., and he will form from them a conception of a tree as distinguished from an oak tree, or a holly tree, or any other tree with which he may become acquainted.

How we form conceptions.—It is clear that this conception is arrived at by a process of generalisation. The points of *difference* which separate trees from other objects,

[1] This may require a moment's explanation. There is a city corresponding to the proper noun *London*; there is nothing precisely corresponding to the term *tree*. There are individual trees, but there is no tree which is neither more nor less than what I mean by the word *tree*. This tree is a fir tree; that is an ash tree, and so on; but what I am thinking *of* is not one or the other, but simply of the ideas covered by the common noun *tree*.

and the points of *agreement* which unite all trees, form together the conception of a tree. A conception is thus a purely mental combination of notions derived from a number of objects having something in common, but having no external object precisely corresponding to it. When I look at an oak tree I perceive its form, size, colour, foliage, roots, etc., and I carry away with me an image more or less exact of that particular oak tree; but I have a conception of an oak tree which is quite distinct from my notion of any oak tree in particular, though it agrees in some respects with my notions of each individual oak tree with which I am acquainted. To *perceive* a particular tree, the tree must be *before* me; to form a conception of a tree *I need not have a tree before me.* It is enough for me to combine out of my past perceptions those characters which I have found all trees to possess in common.

Conceptions vary with our generalisations.—Our conceptions of things vary with the extent of our perception of points of agreement and difference between them. Thus, if I note only the fact that a number of objects have trunks, branches, leaves and roots, I may combine these characters into a conception of a tree; if I further note the particular characters of their trunks, branches, leaves, etc., I may form conceptions of groups or classes of trees, one possessing one set of characters in common, and another another, as of oak trees, holly trees, etc.; if I note the characters of oak trees more closely, I may form conceptions of groups or classes of oak trees, one possessing one set of characters in common, and another another, as of the common oak, the holm oak, etc.

What is wanted in a conception.—Conceptions should be clear and distinct, so that we may know precisely what notions are combined to form them, and thereby be able to determine whether an individual belongs to a class *or not.* The vividness of our conceptions largely depends

upon the vividness of our *perceptions*; the distinctness of our conceptions on the *extent* to which our discriminations are carried.

The value of conceptions is most clearly perceived in connection with language and classification. If things were not classified, we should be obliged to name them individually; whereas, by grouping them, a few names become applicable to any number of individuals included in the groups. It is needless to insist upon the value of classification as a means of discovery: the conception of a class, formed from the perception of a few common characters, will often lead to the discovery of other characters which had not been perceived. Again, it is mainly by conception that we are enabled to acquire any knowledge of facts beyond the range of our personal experience. I have never seen Niagara; but when I am told that it is a waterfall, I can form some idea of it, because I have seen other waterfalls, and have a conception of what constitutes a waterfall.

Difference between conception and imagination.—Strictly speaking we do not form conceptions of things, but only of *classes*. But in common discourse people often speak of having conceptions of individual things. It would be more correct to speak of imagining a thing which has not been subjected to our senses. To imagine is to combine the mental images that have been supplied by perception into new wholes. Thus I have an image of a crystal, and another image of a palace, and by combining the two I may imagine a crystal palace. In teaching history and geography we have constantly to appeal to the imagination to realise events and scenes beyond the range of our own sensible experiences. In such cases it is obvious that the image formed cannot be clearer than the ideas out of which it is compounded, and that clear perception is, therefore, indispensable to a vivid imagination.

Close connection between distinct conceptions and language.—The teacher will do well, in teaching the application of any common name, *i.e.* in teaching the designation of a conception, to indicate precisely the points of agreement which integrate the class of objects included under the name, and the points of difference which separate the class from other classes. He should also be particularly careful to be *consistent and accurate in his own employment of language*, remembering that it is mainly by induction from the language of their seniors, that children learn the application of words. Distinctness of conception is largely aided by precision of language, just as precision of language is largely aided by distinct conception. Our own language will be precise in proportion as our conceptions are distinct; the conceptions of our pupils will be distinct in proportion to the accuracy and consistency of the language which they are accustomed to hear. Children should often be interrogated for the purpose of ascertaining whether the words they hear and employ cover distinct conceptions in their minds.[1]

[1] The following story shows that it is not children only who need to verify their conceptions:—A clergyman, in conversation with an old lady, one of his parishioners, had occasion to suspect, from some remarks she dropped, that she had very hazy views of the Pharisees. This led him to say, 'May I venture to ask whether you precisely know who the Pharisees were?' 'O yes,' she said; 'they were a small race of creatures, not absolutely wicked, but mischievous.' By some odd jumble she had mixed them up with the fairies.

CHAPTER VI.

HOW SHALL WE CULTIVATE THE CHILD'S SENSES?

THE mind, as we have seen, derives its first notions of the external world from the exercise of its senses. 'From the hour of birth, through all the waking moments, there pour in through the eye ever-varying impressions of light and colour—from the dimness of twilight to the utmost solar refulgence—which are reproduced as a highly diversified luminous consciousness. Impressions of sound, of all qualities and intensities—loud and faint, shrill and dull, harsh and musical, in endless succession—enter the ear, and give rise to a varied auditory consciousness. Ever-changing contrasts of touch acquaint the mind with hard things and soft, light and heavy, rough and smooth, round and angular, brittle and flexible, and are wrought into a knowledge of things within reach. And so, also, with the senses of taste and smell. This multitude of contrasted impressions, representing the endless diversity of the surrounding world, has been organised into a connected and coherent body of knowledge.

'After two or three years, the face that was at first blank becomes bright with the light of numberless recognitions. The child knows all the common objects of the house, the garden, and the street, and it not only knows them apart, but it has extended its discrimination of likeness and difference to a great many of their characters. It has found out about differences of form, size, colour, weight, transparency, plasticity, toughness, brittleness, fluidity, warmth,

taste, and various other properties of the solid and liquid substances of which it has had experience. It has noted peculiarities among animals and plants, and the distinctions, traits, and habits of persons.

'Besides this, it has learned to associate names with its ideas: it has acquired a language. The number of words it uses to express things, and actions, and qualities, degrees and relations among these things and actions, shows the extent to which its discriminations have been carried; groups of ideas are integrated into trains of thought, and words into corresponding trains of sentences, to communicate them.' [1]

Nature to be our guide.—When a child goes to school, the first duty of the teacher is to *continue* the method of education which has been pursued by nature: to increase the acuteness of the senses by suitable exercises, to direct them to appropriate objects, to extend the discriminations of likeness and unlikeness in which its present knowledge consists, and to supply words *as they are wanted*, to designate the notions and conceptions which the mind gradually accumulates.

Now Nature's education begins with life, and her school is the school of experience. She teaches nothing but what the child will need to know, and all her lessons are regulated by the degree of development which he has reached and the practical use to which her lessons are to be applied. She is in no hurry.[2] She does not cram. She associates plea-

[1] *Culture of the Observing Powers of Children*, by Miss Youmans, pp. 9–10.

[2] Darwin says of one of his children that he was not able, even at 124 days old, to easily recognise whence a sound proceeded. His power of vision was developed much earlier. His eyes were fixed on a candle as early as the ninth day, and up to the forty-fifth day nothing else seemed thus to fix them. On the forty-ninth day his attention was attracted by a bright-coloured tassel. He could not *follow well with his eye* a swinging object at 7½ months old. He *could move his hands* to his mouth before he was forty days old. *When between eighty* and ninety days old he drew all sorts of objects.

sures and pains with the sensations to which she wishes to direct attention. She repeats her lessons day after day with unwearying patience and with infinite variety of illustration and exercise. She leaves time for her lessons to be thoroughly assimilated and put in practice. She links on new knowledge to old. She converts every sense into an avenue for conveying new ideas, and every instinct into an instrument for stimulating the infant to exercise his senses. She never wearies her pupil. As soon as he is tired of examining one thing she directs him to another, and when he is tired of examining everything, she sends him to sleep. She turns everything to account for the purpose of instructing and educating him, and teaches him invaluable lessons while he seems to be only sucking a coral, or pulling a flower to pieces, or rolling a ball, or smoothing a cat. Examine her pupil at the age of three and you will find that he has learnt the leading elementary truths of Physics without attending the lectures of any learned professor; that he has some acquaintance with Botany, and considerable knowledge of Natural History; that he has a deep insight into human character, and that, without the

into his mouth. When 132 days old he often failed to grasp objects brought within his reach. (*Mind*, July 1877, p. 285.) Tiedemann, who made similar observations, says that one of his infants on the day after his birth moved his eyes in all directions, not at random, but as if they sought objects, and directed themselves by preference *to things in movement*. When he was thirteen days old he showed some traces of acquired ideas, and evidently took notice of the gestures of those who spoke to him. Their words stopped his tears. When eighteen days old he showed signs of the association of ideas. Thus, if he cried, and was placed on one of his sides in the position of suckling, or if he felt a warm hand upon his face, he would become silent, and seek his mother's bosom. At thirty-eight days old the playing of a piano gave him evident pleasure. (Quoted in *Les Trois Premières Années de l'Enfant*, par Bernard Perez.) The order and rapidity with which the faculties of children develope vary very considerably. M. Taine says of one of his infants that at 2½ months she would, on hearing her grandmother's voice, turn her head to the side from which it came. Mr. *Darwin's child*, as we have seen, could not tell well the direction *from which* a sound came when he was 124 days old.

assistance of grammar or dictionary, he has learnt to speak his mother-tongue with tolerable fluency and accuracy; that he has made a commencement in several mechanical crafts, such as those of the mason and carpenter; that he is not wholly ignorant of the Fine Arts, and that he has elementary notions of the truths of morality and religion.

We clearly cannot do better, then, than take Nature for our guide when the child leaves the nursery to go to school. She has mapped out for us the course which we ought to pursue in his formal education. 'New helps and resources may be needed, but the essential means should be the same. Mental growth is to be carried by cultivation to still higher stages, with the same processes hitherto employed. Nothing is more obvious than that the child's entrance upon school-life, instead of being the wise continuation of processes already begun, is usually an abrupt transition to a new, artificial, and totally different sphere of mental experience. Although in the previous periods it has learned more than it ever will again in the same time, and learned it according to the fundamental laws of growing intelligence, yet the current notion is that education *begins* with the child's entrance upon school-life. That which does begin it this time is not *education*, but simply the acquirement of new helps to it.' [1]

The aim which the teacher should set before him in cultivating the senses. — In cultivating the senses, our aim should be, not so much to bring them to their highest possible acuteness, as to fit them for the duties of life, as efficient and ready instruments of the mind. It is a simple extravagance to aim at attaining 'an eye as keen and piercing as that of the eagle; an ear as sensitive to the faintest sound as that of the hare; a nostril as far-scenting as that of the wild deer; a tongue as delicate as that of the butterfly; and a touch as acute as that of the spider.' One

[1] *Culture of the Observing Powers of Children*, pp. 14–15.

is tempted, on hearing such language, to quote the words of Pope :—

'Why has not man a microscopic eye?
For this plain reason—man is not a fly.
Say what the use were finer optics given,
To inspect a mite, not comprehend the heaven?
Or touch, if tremblingly alive all o'er,
To smart and agonise at every pore?
Or quick effluvia darting through the brain,
Die of a rose in aromatic pain?
If Nature thundered in his opening ears,
And stunned him with the music of the spheres,
How would he wish that Heaven had left him still
The whispering zephyr and the purling rill.'

Nor need we have recourse to exercises for the exclusive purpose of cultivating the senses. The same lessons which will supply children with such knowledge as it is most desirable they should acquire, will afford adequate opportunities for the exercise of the senses. Mr. Herbert Spencer says on this point: 'From the Bushman, whose eye, habitually employed in identifying distant objects that are to be pursued or fled from, has acquired a telescopic range, to the accountant whose daily practice enables him to add up several columns of figures simultaneously,—we find that the highest power of a faculty results from the discharge of those duties which the conditions of life require it to discharge. And we may be sure, *a priori*, that the same law holds throughout education. The education of most value for guidance must be at the same time the most valuable for discipline.' [1]

Children must use their senses.—The great thing for the teacher to aim at is to get children to *use* their senses in the acquisition of all knowledge that is based on observation. This they may do either by collecting facts for inductions of their own, or by verifying the observations of others. Words are invaluable helps to the mind in classifying things, in recollecting them, in reasoning from

[1] *Education, Intellectual, Moral, and Physical*, p. 47.

them, and in communicating knowledge relating to them, but they can never supersede the necessity for original observation. They have no meaning until the ideas are lodged in the mind which they designate, and, however familiar they may be to the ears of the children who hear them, they are, without antecedent sense-impressions, a meaningless and unknown language. Children must see, and hear, and taste, and smell, and touch for themselves, before they can benefit by the observation and testimony of others. Without accurate sense-impressions our perceptions must be erroneous; and with erroneous perceptions our conceptions, our judgments, our reasoning, and all our other mental operations must be erroneous. 'The education of the senses neglected, all after-education partakes of a drowsiness, a haziness, an insufficiency, which it is impossible to cure.'[1] The concrete being unknown, or imperfectly known, the abstract is marked by the same characteristics.

Miss Edgeworth says on this point: 'Rousseau has judiciously advised that the senses of children should be cultivated with the utmost care. In proportion to the distinctness of their perceptions will be the accuracy of their memory, and probably also the precision of their judgment. A child who sees imperfectly cannot reason justly about the objects of sight because he has not sufficient data. A child who does not hear distinctly cannot judge well of sound; and if we could suppose the sense of touch to be twice as accurate in one child as in another, we might conclude that the judgment of these children must differ in a similar proportion. The defects in organisation are not within the power of the preceptor; but we may observe that inattention and want of exercise are frequently the causes of what are mistaken for natural defects; and, on the contrary, increased attention and cultivation sometimes produce that quickness of eye and ear, and that consequent readiness of judgment,

[1] *Education, Intellectual, Moral, and Physical*, p. 63.

which we are apt to attribute to natural superiority of organisation or capacity.'

But the formation of *habits of observation* is, perhaps, of more value even than the knowledge gained in childhood by the exercise of the senses. There is no occupation in life in which powers of accurate observation are not needed, to say nothing of the infinite sources of pleasure which those powers open up to us. 'If we consider it,' says Mr. Spencer, 'we shall find that exhaustive observation is an element of all great success. It is not to artists, naturalists, and men of science only, that it is needful; it is not only that the physician depends on it for the correctness of his diagnosis, and that to the engineer it is so important that some years are prescribed in the workshop for him; but we may see that the philosopher, also, is fundamentally one who *observes* relationships of things which others had overlooked, and that the poet, too, is one who sees the fine facts in nature which all recognise when pointed out, but did not before remark. Nothing requires more to be insisted on than that vivid and complete impressions are all-essential. No sound fabric of wisdom can be woven out of rotten raw material.'

CHAPTER VII.

OBJECT LESSONS.

THE intention of object lessons is not so much to communicate information as to put children in the way of collecting information for themselves; to sharpen and direct their senses; to teach them to see things, instead of merely looking at them, and to decompose the confused aggregate of impressions which things at first make upon the mind; to get them to classify and generalise and connect simple phenomena with their antecedents and consequents; to exercise the reason; and to do this in Nature's own way, by bringing the learner, as far as possible, into direct contact with things, and satisfying his own instinctive needs.

The most suitable subjects for a teacher to begin with in the cultivation of the perceptive and conceptive faculty are—

1. Such as afford occupation for the hands (thereby gratifying the love of activity), as well as exercise for the senses, *e.g.* the Kinder Garten 'gifts,' coloured balls, divided solids capable of combination in pleasing groups, etc.

2. *Common things*, such as a table, a chair, a bed, a poker, a pin, a needle, a knife and fork, a scissors, a thimble, a feather.

3. Subjects from *natural history*, such as the cat, the dog, the cow, the horse, the mouse, the robin, a bird's nest, a daisy, an apple, an orange, a potato, wool, the lion, camel, etc.

4. Subjects connected with *food and dress*, such as

bread, cheese, butter, tea, coffee, bacon, rice, sugar, salt, pepper, spice, rice, vinegar; a straw bonnet, cotton, linen, and cloth, a shoe, a button, thread, a hook and eye.

5. Subjects connected with *the human body*, such as the head, the arms, the legs, the hands, the feet, the eye, the ear, the teeth, the tongue, the nose, the skin, the hair.

6. Subjects connected with *domestic and industrial* economy, such as baking, washing, brewing, cooking, building, a butcher's shop, a blacksmith's shop, a tailor's shop, a grocer's shop, a fishmonger's shop.

7. Subjects connected with *familiar physical phenomena*, such as the sun, the moon, the wind, rain, snow, water, day, night, the seasons, clouds.

Classification of object lessons.—Object lessons for infant-schools may be conveniently grouped into four classes, corresponding to the ages of the children :—

(1) Lessons in which the main purpose is to lead children to perceive the parts and the more obvious qualities of objects.
(2) Lessons calling attention to the less obvious qualities and uses of objects.
(3) Lessons involving an easy classification of things.
(4) Lessons directing attention to the adaptation of means to ends, and thereby exercising the reason.

The same subject may be treated in all these ways, the teacher remembering that the senses should be chiefly exercised first, the conceptive faculty next, and the reasoning faculty last of all.

Object lessons should be continued until children take up the formal study of the subjects under which they are included—physical geography, physiology, chemistry, etc. They should not be limited to the contents of the house, but should include those of the fields and the hedges, the

granary and the seashore. They should not cease with early childhood, but should be kept up during youth, as insensibly to merge into the investigations of the naturalist and the man of science.'[1] As far as possible, even in the infant-school, lessons relating to connected and kindred subjects should be given in a series, so that the relations between things may be perceived, and in order that new knowledge may be linked on to the old. 'Alike in its order and its methods,' says Mr. Herbert Spencer, 'education must conform to the natural process of mental evolution; there is a certain sequence in which the faculties spontaneously develope, and a certain kind of knowledge that each requires during its development; and it is for us to ascertain this sequence, and supply this knowledge.'

Apparatus and illustrations.—The teacher should in all cases take care to provide himself beforehand with the apparatus necessary for his lesson, the apparatus and the experiments made with it being, if properly used, in themselves the lesson, and the teacher merely a demonstrator, whose function is not so much to communicate knowledge by word of mouth as to *direct* and *test* the child's powers of observation and reasoning. Careful attention should be paid to the order in which the experiments are performed and the specimens displayed.

Specimens.—If possible, the teacher should have *the actual object* on which the lesson is, placed before the children; and a specimen of it should be given to each child. For instance, if the lesson were on a daisy, each child should have a daisy, and should examine it for himself under the teacher's direction, first taking off one part and then another, and laying each part carefully aside. An enthusiastic teacher will always be on the look-out for specimens for the illustration of his lessons, and will take advantage of times and

[1] Mr. Herbert Spencer.

opportunities to secure them. I recently heard a lesson on the bee, and found that the teacher had had the forethought to secure a complete hive of dead bees, from which he was enabled to furnish every child with a handful at the beginning of the lesson. Every school should be provided with (1) a small *cabinet of objects* illustrating the animal, vegetable, and mineral kingdoms, and the more important arts and manufactures; (2) a museum of curiosities and other objects of interest, to which the children should be encouraged to contribute; and (3) apparatus for melting, evaporating, straining, measuring, weighing, etc.

Pictures.—If the actual object cannot be had, then *a picture* of it should be introduced; but it should not be forgotten that a picture is only an imperfect symbol of the object which it represents. It is, of course, a more perfect symbol than a word, because it is not arbitrary and bears some resemblance to the real thing; but it is addressed to only a single sense, and is very liable to mislead even that. It can give no idea, except by way of suggestion from the association of ideas, of resistance, weight, texture, etc. Pictures that are not on the same scale as the objects represented should contain some familiar object to furnish a standard for relative measurement. A picture of a mouse should contain a cat. A picture of an elephant should contain a man. This rule should be invariably observed in lessons on Natural History.

Models are still better than pictures. They can be taken to pieces, set in motion, and shown in a wide variety of situations. They appeal at once to the instincts of knowledge, activity, and transformation.

The black-board. — As an auxiliary to all other modes of illustration the *black-board* should be freely used. Every teacher should be able to draw rapidly and effectively before his class. An illustration may often be drawn on the

black-board when no other form of illustration is available. Children love to see a drawing grow under their eyes. Moreover a black-board drawing enables the teacher to present a complex object bit by bit, and to exaggerate the scale of important parts of an object that are too small to be clearly seen in a model or complete drawing. In lessons on subjects in which *form* plays an important part, as in Botany, it is well to get the children to co py for themselves the forms set before them.

Words to be communicated after the ideas which they represent.—In his desire to get children to acquire *real* knowledge, the teacher should not forget the importance of their acquiring *verbal* knowledge commensurate with it. Words are indispensable as the symbols of knowledge and should be taught as occasion requires, care being taken that the knowledge of the thing or quality takes precedence of the knowledge of the word designating it. There are some qualities that are common to large classes of objects. It is not necessary to introduce these into every lesson on objects possessing them. Once they are well known, the teacher may assume the knowledge of them and direct his attention more particularly to distinctive qualities.

All new words should be written on the black-board, and an abundance of examples should be given and required in which the words occur.

Importance of neatness.—Teachers cannot be too careful in performing experiments, in handling and arranging specimens, and in drawing and writing on the black-board, to set an example of neatness, order, and symmetrical arrangement. Clumsy experiments, disorderly heaps of specimens, bad drawings, illegible writing, and confused black-board work have necessarily a bad moral and intellectual effect on the minds of the children before whose eyes they are constantly presented.

CHAPTER VIII.

ON THE SPECIAL VALUE OF THE PHYSICAL SCIENCES AS INSTRUMENTS FOR CULTIVATING THE SENSES.

THE special value of the Physical Sciences as educational instruments lies in the fact that they bring the mind, if properly studied, in contact with *things* and not mere *words*, and afford suitable opportunities for *systematic training* of the observing faculties. 'A lesson one day on a bone, the next on a piece of lead, and the next on a flower, may be excellent for imparting "information," but the lack of relation among these objects unfits them to be employed for developing connected and dependent thought. This teaching can be thoroughly successful only when the objects studied are connected all together in a large, complex whole, as a part of the order of nature. The elementary details must be such as children can readily apprehend, while the characters and relations are so varied and numerous as to furnish an extended course of acquisition issuing in a large body of scientific principles. Only in a field so broad and inexhaustible as to give play to the mental faculties in their continuous expansion can object-studies have that real disciplinary influence which is now so desirable an element of popular education.' (Miss Youmans).

What should be aimed at in physical studies. The object which the teacher should set before him in teaching any physical science should be :—

(1) To let facts speak for themselves ;

(2) To supply suitable experiments and specimens for the establishment of general laws ;

(3) To secure accuracy and solidity in the knowledge acquired;
(4) To connect scientific principles with their practical applications;
(5) To sharpen the observing powers;
(6) To cultivate the imagination in the apprehension of theories where proof is not available;
(7) To exercise the reasoning powers;
(8) To form good intellectual habits.

The Physical Sciences most suitable for these purposes are Botany, Chemistry, Human Physiology, Magnetism and Electricity, Geology and Physical Geography.

Botany.—Of these Botany is, perhaps, the most valuable and available, from an educational point of view. Its special advantages are these:—

(1) The materials for its study are everywhere accessible;
(2) The study can be carried on in an ordinary school-room and requires little apparatus;
(3) The elementary facts are so simple that their study can be commenced in early childhood, and so numerous as to admit of a prolonged course of observation;
(4) The study may be stopped at any stage, and the advantages gained are substantial and valuable;
(5) The means are furnished for organising object-teaching into a systematic method;
(6) The study is unrivalled in the scope it offers to the descriptive powers, as its vocabulary is more copious, precise, and well-settled than that of any other of the natural sciences;
(7) It is congenial with the pleasurable activity of childhood and enforces rambles and excursions;

(8) It has a practical value in agriculture and horticulture, pursuits in which more people are occupied and interested than in all others put together;

(9) The study of plant-forms opens up to us a world of grace, harmony, and beauty, that is not without influence upon the æsthetic feelings, and the appreciation of Art;

(10) Botany is a source of pure and unfailing personal enjoyment;

(11) It involves, in its higher branches, the employment of the microscope, the most delicate and powerful of all instruments of observation;

(12) It opens the field of experiment and affords opportunity for cultivating manipulating processes;

(13) It has intimate connections with all the other sciences—Physics, Chemistry, Geology, Meteorology, and Physical Geography, and is the proper introduction to the great subject of Biology—the science of the general laws of life. (Abridged from Miss Youmans).

The use of books in the study of physical science.—Books cannot be wholly dispensed with in the study of Physical Science, but they should be subordinated to the study of things. Their proper use would seem to be to *follow* observation and experiment, and present in accurate language the truths elicited by personal investigation.

In the earlier stages of teaching physical science the teacher should rely mainly upon oral instruction, his immediate object being to stimulate curiosity and minimise difficulties, so as to render the subject as attractive as possible. In the later stages it is well for the class to go firstly over the ground which the teacher proposes to traverse by themselves. They will then be better prepared for his instruction. They will have thought themselves hungry, and will come to his teaching with an intellectual appetite.

CHAPTER IX.

LESSONS ON COLOUR AND FORM.

ONE of the earliest impressions which the mind is capable of receiving is that produced by the undecomposable sensation of light. Following the order of nature, the teacher should make the pupils acquainted at the earliest stage of their education with the more marked differences of colour, taking advantage of every convenient opportunity to direct the eye to harmonious combinations of colour. The apparatus requisite for a series of lessons on Colour would be—

(*a*) A sheet of coloured squares showing
   1. Black and white.
   2. Primary colours.
   3. Secondary ,,
   4. Common shades of different colours.

(*b*) Loose cards coloured in the same way.
(*c*) Coloured wools.
(*d*) Coloured textile fabrics.
(*e*) Coloured pictures.

As the colours are learnt the children should be required to match the loose cards from the coloured squares, or *vice versâ*, to match the squares from the cards; to name familiar objects of the colour which is under consideration; to name shades of the colour, etc.

The harmony of colours is best taught by familiarising the eye with instances of it. The teacher should carefully avoid, in the use of coloured balls and wools, and, indeed,

at all other times, inharmonious combinations of colour. Female teachers cannot be too particular in the selection of the colours of their own articles of dress. Careful attention should also be paid to the colouring of the school, and the selection of pictures for the walls.

The most elementary lessons on form should be on the Kinder Garten 'gifts,' which admit of being handled as well as seen, the notion of solid form being, as we have seen, mainly derived from tactile sensations.

The apparatus required for teaching superficial form should consist of—

(*a*) A sheet showing the commoner geometrical plane and solid figures.
(*b*) A box of wooden models to correspond.

The children should be required—

(1) To count the number of sides which each figure possesses as the teacher runs his finger over them or points to them on the sheet;
(2) To match the models from the sheet, and the figures on the sheet from the models;
(3) To name the figures *after* the figures have come to be readily identified;
(4) To name familiar objects resembling the figures;
(5) To describe the shape of familiar objects; and so on.

Linear form is best taught in connection with drawing.

In teaching drawing the children should not be detained too long over unmeaning straight lines and curves. Their delight in drawing mainly arises from the satisfaction which it affords to their imitative and creative instincts, and is naturally greatest in representing objects in which they take an interest.

The order of a series of elementary drawing lessons would appear to be—

(1) The representation of common objects bounded by straight lines, *e.g.* a post, a stool, a bench, a box, a ladder, a comb, a bed, a clothes-horse, a table.

(2) The duplication of straight lines as seen in various common objects, such as the preceding series.

(3) The representation of common objects in which curves appear, *e.g.* a clock, an arched window, a kite, a jug, etc.

(4) The representation of symmetrically divided objects, needing measurement with the eye, *e.g.* a window showing panes, a door showing panels, a Maltese cross, the front of a house, etc.

As soon as children have acquired some facility in drawing *from the flat* they should draw from models.

The teacher should always show young pupils where to begin in drawing an object, and should draw it himself *bit by bit*, on the black-board, taking care that they keep pace with him. A complex-looking object frightens a child, but if it be decomposed and presented a line at a time, he is encouraged to attack it. There is this further advantage in this method: the children are kept well together and are prevented from wasting their time in needless use of the india-rubber.

Inventive drawing is best taught after children have acquired some facility in drawing straight lines and curves, and the commoner geometrical forms. The apparatus required for it are—

(1) Books ruled for the purpose.
(2) The black-board.

The children should be shown how a figure may be ornamentally filled up, and after some practice in copying examples, should be encouraged to make designs of their own.

CHAPTER X.

THE SENSES IN RELATION TO THE ORDINARY SUBJECTS OF SCHOOL INSTRUCTION.

THERE are few subjects of school instruction in which the senses might not play an important part, if teachers would only set children to observe for themselves, instead of giving them verbal accounts of observations made by other people. Even in those exercises in which children are bound to see things for themselves, such as writing and drawing, the teacher may do much to make them observe more accurately, by (1) getting them to decompose complex objects, (2) by classifying the parts, and presenting them in the order of their simplicity, and (3) by a critical comparison between the object and its copy.

Reading is an art which is mainly acquired through the visual memory. We are only concerned, for the present, with that part of it which deals with the learning the *shapes* of letters and printed words.

Before children begin to learn the Alphabet they should have their eyes trained to perceive the elements of which letters are composed, and their fingers trained to reproduce them. All the capital letters (and those only should be taught first, because they are the simplest in outline) are constructed out of these four simple elements, viz. (1) the vertical line, (2) the horizontal line, (3) oblique lines, (4) the circle.

By judiciously constructed exercises, based on these elements, the children may be led on to produce the letters as they are learnt. The advantages of this method are obvious.

The complex letter is decomposed and reconstructed and, in the process, kept continuously under the eye.

The reproduction of the letters should be made in a variety of ways, so as to satisfy the instincts of activity and construction and avoid monotony. Thus the children may be required to make the letters (1) in the air, (2) on the black-board, (3) with bits of wood or paper prepared for the purpose, (4) with peas and sticks, and so on. Again, the children should be made to match letters for the purpose of compelling them to notice (1) the points of agreement and (2) the points of difference between them. Again, they should be required to convert one letter into another, as *I* into *T*, *F* into *E*, and so on.

Picture alphabets are of little use except for the purpose of attracting the attention and making the Reading exercise pleasurable. 'A was an Archer,' with its accompanying picture, throws no light on the form of the letter *A*, and can only assist the memory by calling up the picture in which the *A* appears. Analogies between the letters and familiar objects (especially if traced by the children themselves) are much more valuable. 'Y is like a wine-glass,' leads the child to institute a comparison between the two, and forms an association which fixes the shape of the letter in the memory. The *Y* calls up the wine-glass and the wine-glass calls up the *Y*.

Letters that closely resemble one another, as *c* and *e*, *b* and *d*, *p* and *q*, should be closely compared, and their differences insisted on. Here mnemonic rhymes may be introduced to fix the differences in the memory.

Anomalous words should be taught as visual wholes, and the hand should form them as soon as the eye has learnt to identify them.

The *ear* should be practised by short exercises in pronunciation and enunciation, and the teacher should make a free use of the black-board in making visible to the *eye letters not* sounded or incorrectly sounded, care being

always taken that no wrongly-spelled word is ever put on the black-board. Letters that are not sounded may be crossed through; sounds that are inaccurate may be represented above or below the proper symbol; but the picture of the word as properly spelled should never be disturbed. *We are haunted not only by the ghosts of errors we have committed, but even by the ghosts of errors we have seen or heard.*

Spelling stands on the same footing as the mechanical art of Reading. If spelling were phonetic, we should not need to remember it; we should have only to apply general rules to particular cases; but an arbitrary mode of spelling like our own is mainly remembered by the eye, and must be learnt *through the eye.* The mere repetition of the letters contributes very slightly to fix spelling on the memory, there being little or no association to assist us in retaining the letters. In the visible word the whole picture of the word is the aggregate of the parts; in the audible word the whole word is not the aggregate of the alphabetic names of the letters, and only an approximate aggregate of their phonic equivalents.

The best means of teaching spelling are (1) transcription, (2) dictation after preparation from a book. The correct form of mis-spelled words should be written down sufficiently often to leave a stronger impression upon the mind than the blunder. We must not suppose that we can wholly *obliterate* a blunder. Nature is not to be tampered with in that way. All we can do is to substitute right impressions for wrong ones, and leave the wrong ones to die out, so far as they can die, from the absence of repetition and of associations that accompany repetition.

Words, of which the spelling is often confounded, should be brought into close juxtaposition, that the eye may dwell on the points of agreement and difference between them.

The black-board should be used in tracing out the

leading rules of spelling. A few well-chosen examples will suffice to indicate to the eye the law which they illustrate.

Writing, like Reading, is mainly dependent on the visual memory, and requires careful cultivation of the eye. The eye will be assisted in learning the forms of the symbols, and the hand in reproducing them, by copying the elements of which the symbols are composed, first separately, after careful analysis, and then in combination. This should not be persisted in too long. Children prefer words that convey a meaning to unmeaning symbols. As they advance, their attention should be directed to—

(*a*) The normal size of the letters in the hand chosen;
(*b*) The normal spaces;
(*c*) The normal inclination;
(*d*) The normal proportions of those parts of letters which are above or below the line;
(*e*) The normal height of the dots to the *i*'s and the strokes to the *t*'s;
(*f*) The balance of curves, etc.

Children should be shown where to begin letters, and the black-board used to exemplify the points insisted on.

Arithmetic.—Children have no idea of abstract number until long after they have been familiar with concrete numbers. Numbers, therefore, should be, at first, presented to them in the concrete. When children are familiar with three balls, three oranges, three fingers, etc., they will gradually form a conception of three apart from any concrete objects. The apparatus most useful for giving first ideas of number are—

(1) A ball-frame;
(2) Small bags of marbles containing ten each, and larger bags capable of containing ten of the smaller, or Mr. Sonnenschein's models;

(3) Divided solids ;

(4) Pictorial representations of numbers by dots, lines and familiar objects ;

(5) Lengths of wood or paper, divided into equal parts, to illustrate fractions.

There is an advantage in always representing the lower numbers in the same way, so that the eye may associate a definite and unaltering picture with them. Let 2 be always represented by two *horizontal* dots ; 3 by two horizontal dots and one placed over them ; 4 by two rows of horizontal dots, and so on. In this way children grow accustomed to decompose numbers, and are prepared for the simple rules.

The Addition, Subtraction, Multiplication, and Division Tables should all be *verified* on the ball-frame.

Specimens should be provided of all the standard weights and measures. The ball-frame or black-board might have inches and feet measured on one of its sides. The longer linear measures should be marked off on some conspicuous part of the wall. A cubic inch and a cubic foot should be exemplified by wooden models. A superficial foot or yard should be measured in some open space on the school floor.

All the tables of money, weights, and measures should be verified before they are learnt by heart, and the children should be practised in actual weighing, measuring, and exchanging.

Whenever it is possible, children should be enabled to give *approximate* estimates of weights and measures by sight, or muscular effort, or reference to their own bodies.

The dimensions of the school ought to be well known by the teacher and children as a standard of reference.

Models showing the volume of an ounce of air and a pound of water will be found useful in teaching arithmetic and meteorology.

Geometry and Mensuration.—Before children learn Euclid's definitions they should be thoroughly familiar with

the concrete examples of the figures to which they relate. A simple *cube* will illustrate points, straight lines, the square, parallelogram, etc. Exercises should be given in drawing and cutting out simple geometrical figures.

Such propositions as admit of proof by *superposition*, *i.e.* by placing one figure on the top of another to show their coincidence, should be first taught in this way. When a child has actually cut up the square on the hypothenuse of a right-angled triangle, and seen that it will fit into the squares on the sides containing the right angle, he will take all the greater interest in the geometrical proof of the proposition.

All rules in Mensuration should be *verified* by models in wood or paper showing the number of units of measure in the superficies or solid, as the case may be.

History.—Wherever there are any local historical remains, such as ancient castles, battle-fields, camps, old streets, churches, abbeys, museums, etc., the teacher should, as far as possible, connect them with his lessons in History. In these cases the Past speaks for itself, but, as a rule, the Past is only intelligible through the Present, and the teacher will have to draw very largely on the conceptive faculty of his children. He will succeed in this in proportion to the extent to which he connects their own experience with the events and scenes which he sets before them.

The apparatus most useful for lessons in History would be—

(1) A map of the country or locality showing its political features at the time referred to, and its physical features so far as they help to explain the historical facts;
(2) Genealogical charts and synchronistic tables;
(3) Drawings illustrating habitations, dress, modes of warfare, manners and customs, architecture;
(4) Clay models of battle-fields, sieges, etc.;
(5) Pictures of striking incidents.

Geography admits of constant appeals to the visual faculty, and should commence with the physical features of the country at our own doors. Here, also, we have to draw largely on the conceptive faculty to explain what is remote from our experience; but the near throws more light on the remote in space than in time. A stream of water running down the gutter by the road-side will illustrate the laws that regulate the phenomena presented by the Amazon or the Ganges. A hill of two or three hundred feet high is an approach towards Mont Blanc or Mount Everest. A pond is the ocean in miniature.

The apparatus needed for lessons in Geography would be—

(1) A meridian line painted on the floor of the school, or a magnetized knitting needle freely suspended by a collar of paper, so as to show the points of the compass;
(2) A ground plan of the school;
(3) A map of the district in which the village is situate;
(4) Maps of the county, country, continent, etc.;
(5) Specimens of the products of the countries treated;
(6) Relief maps or clay models of the countries treated;
(7) Sections of the country in different directions;
(8) Pictures or drawings illustrating vegetable and mineral productions, physical peculiarities, people, houses, costumes, manners, and customs;
(9) Special maps to illustrate distribution of productions, population, climatic phenomena, etc.
(10) A globe.

A careful and thoughtful survey of this apparatus, under the direction of an intelligent teacher, ought to render much verbal description and explanation unnecessary. The facts would speak for themselves.

The teacher of Geography should always keep in memory convenient units of measurement to be applied to large numbers, *e.g.* the area of the county, the length of

the nearest large river, the population of the town, the height of some well-known public building, etc. All these are helps to the imagination in grasping large numbers.

Grammar deals with words, and not with things, and affords little direct exercise for the senses. But the teacher who deals with the subject inductively will assist the mind in discovering many of the facts of Grammar, such as inflexions and syntactical rules, by placing well-selected examples in close juxtaposition on the black-board. The eye will see for itself what the Grammar teaches.

If concrete terms be used in connection with the parts of speech, great care should be taken *not to confound words with the things and relations which they denote.*

LONDON: PRINTED BY
SPOTTISWOODE AND CO., NEW-STREET SQUARE
AND PARLIAMENT STREET

THE

TEACHER'S COMPLETE MANUAL

OF THE

SCIENCE AND ART OF TEACHING.

INCLUDING

TWO SERIES OF INDEPENDENT MANUALS.

The First Series, which relates to the SCIENCE of Teaching, consists of—

1. THE CULTIVATION OF THE SENSES. Price 8*d.*
2. THE CULTIVATION OF THE MEMORY. Price 6*d.*
3. ON THE USE OF WORDS. Price 8*d.*
4. ON DISCIPLINE. Price 8*d.*
5. ON CLASS TEACHING. Price 6*d.*

The Second Series, which relates to the ART of Teaching, consists of—

1. HOW TO TEACH GRAMMAR. Price 8*d.*
2. ARITHMETIC AND HOW TO TEACH IT. Price 8*d.*
3. HOW TO TEACH GEOGRAPHY. Price 6*d.*
4. HOW TO TEACH HISTORY. Price 8*d.*
5. HOW TO TEACH READING AND WRITING. Price 6*d.*
6. SCHOOL FURNITURE AND APPARATUS, AND THEIR USES. Price 6*d.*

THE PUPIL-TEACHER'S COURSE OF MATHEMATICS.

Part I.—EUCLID, Books I. and II.

WITH NOTES, EXAMPLES, AND EXPLANATIONS.

By a late Fellow and Senior Mathematical Lecturer; Examiner for the Oxford and Cambridge Board, the Cambridge Syndicate, &c.

Price 1*s.* 6*d.*

NATIONAL SOCIETY'S DEPOSITORY, WESTMINSTER;
And through all Booksellers.

NATIONAL SOCIETY'S PUBLICATIONS.

READING BOOKS.

NATIONAL READING BOOKS, adapted to the requirements of the New Code.

			s.	d.
The National Primer.	Introductory to Book First	per doz.	2	0
Book the First.	(STANDARD I.)	do.	2	0
——— **Second.**	(STANDARD II.)	each	0	6
——— **Third.**	(STANDARD III.)	do.	0	8
——— **Fourth.**	(STANDARD IV.)	do.	1	0
——— **Fifth.**	(STANDARD V.)	do.	1	4
——— **Sixth.**	(STANDARD VI.)	do.	1	4

NATIONAL READING BOOKS (Religious Series).

No. I.	(STANDARDS I. & II.)	per doz.	2	0
No. II.	(STANDARD III.)	each	0	4
Readings on the History of our Lord Jesus Christ		do.	1	4
Reading Lessons for Evening Schools,	Pt. I., cloth	do.	0	6
———	Pt. II., do.	do.	0	8
Readings for Schools,	cloth	per doz.	2	8
Reading Lessons,	Part I., cloth	do.	2	8
———	Part II., cloth	do.	2	6
———	two Parts together	do.	4	8

ARITHMETIC.

NATIONAL ARITHMETIC, adapted to the requirements of the New Code. New and Revised Edition.				
Part First.	(Including STANDARDS I. & II.)	per doz.	1	4
—— **Second.**	(STANDARD III.)	do.	1	4
—— **Third.**	(STANDARD IV.)	do.	1	4
—— **Fourth.**	(STANDARD V.)	do.	1	4
—— **Fifth.**	(STANDARD VI.)	do.	1	4
Key—Part I. containing Answers to the Questions in Parts I. II. and III.		each	0	3
Key—Part II. ditto, parts IV. V. and VI. ...		do.	0	3
Parts together, with Keys, ditto		do.	1	4
Arithmetical Cards, with Answers, adapted to the New Code. New and Revised Edition.				
STANDARD I.		per pkt.	0	8
——— II.		do.	0	8
——— III.		do.	0	8
——— IV.		do.	0	8
——— V.		do.	0	8
——— VI.		do.	0	8
Manual of Arithmetic for National Schools, canvas		each	0	7
Key to ditto		do.	1	0
Arithmetical Tables, New Edition, thoroughly revised		per 100	10	0
Mental Arithmetic		per doz.	1	4

GRAMMAR.

		s.	d.
National English Grammar, adapted to the requirements of the New Code.			
Part I. Standard II....	per doz.	1	0
— II. ——— III....	do.	1	0
— III. ——— IV....	do.	2	0
— IV. ——— V. & VI.	do.	2	0
Manual of English Grammar, canvas	each	0	7
Abstract of English Grammar	per doz.	1	4
Outlines of English Grammar, New Edition, thoroughly revised	do.	1	4

GEOGRAPHY.

Elements of Geography, New Edition, thoroughly revised	each	0	6
The World, an Introduction to General Geography	per doz.	1	4
Europe	do.	1	4
Asia	do.	1	4
England and Wales	do.	1	4
Colonies of Great Britain, New Edition, cloth bds.	each	1	9
Scripture Geography, Part I., Palestine, Syria, and Phœnicia	per doz.	1	4
Scripture Geography, Part II., Chaldea, Arabia, Asia Minor, &c.	do.	1	4
——— 2 Parts together, in canvas	each	0	4
Text Book of Scripture Geography, cloth ...	do.	2	0
Physical Geography of England and Wales ...	per doz.	1	4
——— **British India**	do.	1	4
Industrial and Commercial Geography	do.	1	4

HISTORY.

Outlines of English History, New and revised Edition, with 9 Maps, cloth	each	2	6
Summary of the History of England	per doz.	1	4

SPELLING BOOKS.

Spelling Course	per doz.	1	4
——— **Exercises**	each	0	6
——— **Cards**, Nos. 1 to 24, in packets of 12 Cards of any number	per set	0	2
——— **Lessons**	each	0	2
Rules for Spelling	do.	0	4
——— in canvas cover	do.	0	6

POETRY.

Hymns for the Christian Seasons...	per doz.	1	4
Class Book of Poetry, cloth, limp...	each	1	4
——— boards	do.	1	8
School Poetry, canvas	do.	0	6
Songs for Schools	per doz.	1	4

ALGEBRA.

		s.	d.
Elementary Algebra, Part I. STANDARD IV. ...	per doz.	1	6
——— II. ——— V. ...	do.	1	6
——— III. ——— VI. ...	do.	1	6
——— IV. Supplementary, with Answers to the Four Parts	do.	2	0
The Four Parts bound together, limp cloth	each	0	10

ATLASES.

General Atlas, containing 29 Maps, coloured, with an Index. New Edition, cloth	each	4	0
Class Atlas, containing 16 Maps, coloured, sewed	do.	2	6
——— cloth	do.	3	6
Scholar's Atlas, containing 14 Maps, plain ...	per doz.	2	0
——— coloured ...	each	0	4
The School Atlas of Physical Geography, with Explanatory Matter, cloth boards	do.	8	0

BOOKS SUITABLE FOR RELIGIOUS INSTRUCTION.

Life and Travels of St. Paul	per doz.	1	4
Manual of Family Devotion, cloth, red edges ...	each	1	8
——— Scripture Thoughts, Texts and References	per doz.	1	4
Notes, Questions, and Answers on the Collects. New Edition, cloth	each	1	8
——— Gospels for the Christian Year. New Edition, cloth... ...	do.	3	0
——— Parables, cloth	do.	1	8
Prayers and Graces for School Children (stiff paper)...	per 100	10	0
——— for Elder Children	do.	4	0
——— Young Children (on a Card)	do.	8	0
Pronunciation of Scripture Proper Names ...	per doz.	1	4
Questions on Patriarchal History, stitched	per 100	16	0
——— cloth	per doz.	4	0
——— the Orders for Morning and Evening Prayer, stitched...	per 100	11	0
Questions on the Orders for Morning and Evening Prayer, cloth	per doz.	4	0
——— the Sabbath	per 100	6	0
Readings on the History of our Lord Jesus Christ ...	each	1	4
Some of the Bonds of Society. By Rev. Canon Gregory	do.	1	6
Summary of the Historical Books of the Old Testament	per doz.	1	4
The Epistles for the Christian Year, with Notes. By W. Benham. Cloth	each	3	0
The Gospel of St. Matthew, with Notes. By Rev. *W. Benham.* Cloth	do.	3	0